1. When numerically solving a differential equation, it is always better to choose a smaller st. Explain why or why not.

Ans. False

This is because while using a smaller At will reduce the numerical discretization error, it heads to an increased number of computations to reach a desired total duration. This increase in computations results in higher round-off errors due to limits of machine accuracy.

2.

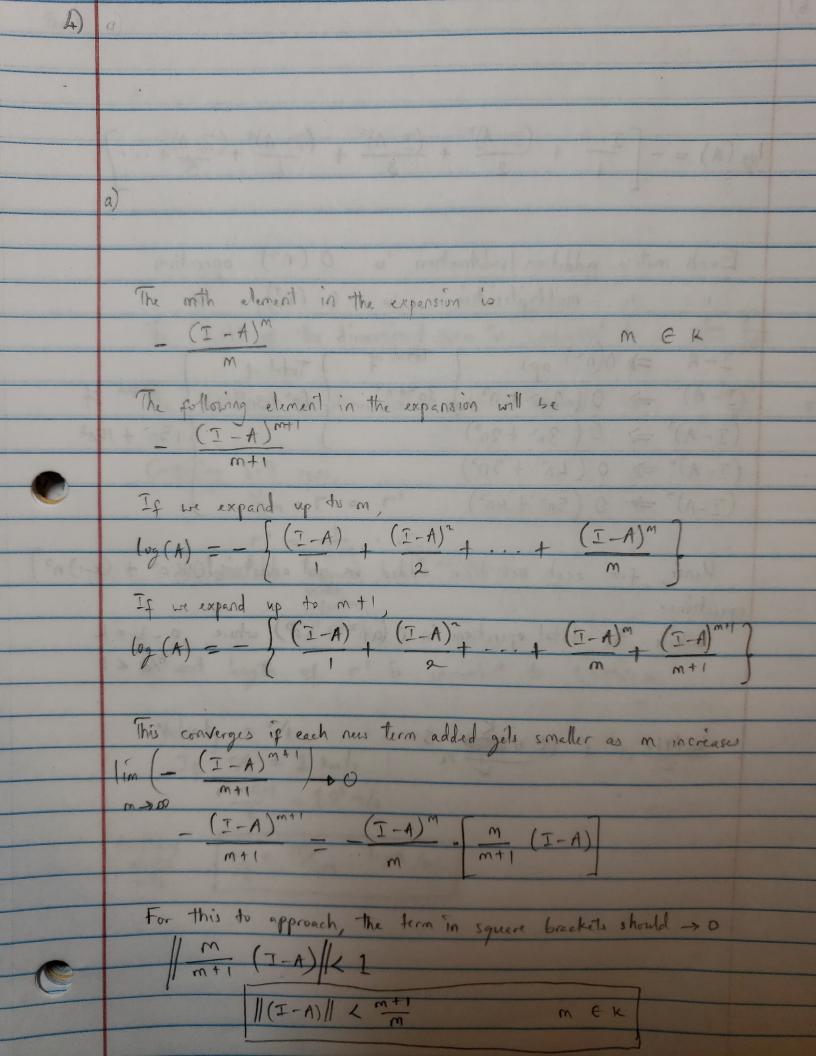
Ans.

Adaptive methods are methods in which the time step size is dynamic. It is computed at each timestep in order to optimize computational efficiency.

Non-adaptive methods use a constant st.

Adaptive methods are most useful in system with non-uniform dynamics. That is systems that have a fairly simple behaviour during run times, and significant dynamics at a specific section. We essentially adapt our integrator to poeus on regions of key dynamism.

A major disadvantage is that we cannot preallocate memory because we do not know how long it will take to run as At changes in each timestep.



$$\log(A) = -\left[\frac{I-A}{1} + \frac{(I-A)^2}{2} + \frac{(I-A)^3}{3} + \frac{(I-A)^4}{4} + \frac{(I-A)^5}{5} + \cdots\right]$$

Mince, for each new term added, we get additional O(kn + (k-1) n<sup>3</sup> operations.

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	1 unit length of +1 is equivalent to (GM). m
	1 unit length of r'is equivalent to (GM). m
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	$T_{s} = 1 \times m/s$
	$T_f = \frac{1}{4} \times \frac{1}{4} $
	Arbitrary [1] = 103/GM length /sec
	velocity 1/4 = GM regin /sec

51) Analytically show that if the first ster is initially stationers at the origin, and if the second and third star satisfy re= - is and with velocities va = - Vs, that The first star will remain stationary for all time. I this solution stable if r, is perturbed? Soln ドーニーニョーニョ If first star is initially at origin, then Fr = (0,0) Indiana of any lederal finte = - Fill (2)  $\frac{1}{r_{1}} = \frac{(-r_{1})^{3}}{(-r_{3})^{3}} \frac{(-r_{3})^{3}}{(-r_{3})^{3}}$ 12/3 1 12/3  $=\frac{7}{|\vec{r}_{3}|^{2}}+\frac{7}{|\vec{r}_{3}|^{2}}$ Hence, The first star remains at rest and never accelerates If Fi is slightly perturbed, egns (2) and (3) no longer hold and star 1 begins to move.